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A Novel Approach of Covaxin Vs Covishield Via Micro Topological Spaces

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***Abstract*:** The intension of the work is to establish the Micro topological spaces on some Medical Applications regarding the impact of Covid-19 vaccines (Covaxin and Covishield) which are circulated in India. Although the protective efficacy is frequently discussed, little is known about the real-world post-vaccination experience outside of clinical trial conditions. With the short term post vaccination side effects, it is important to discuss the Covid-19 vaccines safety and adverse events for analyzing the minimum impact. In this paper various Micro topological structures are applied, analyzed for prediction and found a significant difference between side effects and efficacy of Vaccines through the accuracy of approximation.

Keywords: *Reduct, Core, Micro topology, Micro-neighbourhood, Micro-continuous, Micro-homeomorphism, Micro S_p-continuous, Micro S_p-homeomorphism, Micro S_p-neighbourhood.*

1. Introduction

Topology is the discipline of Mathematics whose objective is to clarify and investigate the notions of continuity in the environment of Mathematics. Topology considers two types of deformations: homeomorphic and homotopies. A topological attribute is one that is invariant under such deformations. Topology based methods are of increasing importance in the analysis and visualization of all forms of field data. Lellis Thivagar and Richard [6] introduced the idea of Nano topology as an extension of set theory for such study of intelligent systems with little or imperfect knowledge. As an extension of Nano topology, the Micro topology was introduced by S.Chandrasekar [12] in 2019. M.Josephine Rani [5] has carried out the risk factors of the identification of Covid-19 and select the drugs required to determine the level of health in specific patients through Micro topological directions, some of which were shown in her pioneering work. A survey of symptoms following Covid-19 vaccination in India by Rajeev Jayadevan et al [11] reported that female respondents experienced more side effects. Also reported that, fever and pain at the site of injection had significant association with gender. In line with the findings of Deepthy et al [3], body pain, fever, fatigue, muscle pain and head ache

were the side effects that had a significant association with age and majority of these conditions were observed in the age group below 35 years.

[10]Covid-19 make huge impact on globe level more than million people lost their life. One of the primary reasons for hesitancy in taking Covid-19 vaccines is the fear of side effects. Another important aspect of this new normal life is getting vaccinated against Covid-19 and get covered with good health insurance. While doctors believe that getting the Covid-19 vaccine may not be enough in avoiding infection, but it can certainly control the severity of the condition. The medicine protects us from covid-19. But some of the more common side effects might impact our regular life. Although many other brands of Covid-19 vaccination such as Russia′s Sputnik V, America′s Pfizer and Moderna vaccines are making inroads into the Indian market, Covaxin and Covishield remain the most popular and readily available options.

Covaxin is the first Indian Vaccine against the Covid-19 causing coronavirus. It was made by Bharat Bio-tech, a Hyderabad based bio-technology Company. It is made from an inactivated virus; the virus was killed before incorporating it into the vaccine. When introduced to a healthy human body, the inactivated virus triggers an immune response, developing antibodies to fight it. These antibodies prove useful in preventing a severe case of Covid-19 when the person is exposed to live coronavirus. The common side effects of Covaxin include fever, fatigue, nausea, pain and swelling at the injection site and muscle ache.

Covishield was developed by Oxford-Astra zeneca and its Indian variant is manufactured by Serum Institute of India (SII) Pune. While Covaxin is made using an inactivated coronavirus, Covishield is made from a viral vector obtained from a different virus usually found in Chimpanzees. The viral vector is modified to imitate the novel Coronavirus. Covishield's side effects are fever, head ache, fatigue, weakness, pain and tenderness at the injection site. The findings of this study revealed all the approaches built from Micro-continuous and Micro S_p-continuous have high classification accuracy and are generally comparable in predicting Covaxin Vs Covishield: Which is better in India.

2. Preliminaries

Definition 2.1.[6] Let U be a non-empty finite set of objects called the universe and R be an equivalence relation on U named as the indiscernibility relation. Elements belonging to the same equivalence class are said to be indiscernible with one another. The pair (U, R) is said to be the approximation space, Let $X \subseteq U$, Then

(i) The Lower approximation of X with respect to R is the set of all objects which can be certain classified as X with respect to R and is denoted by $L_R(X)$. That is $L_R(X) = \bigcup_{X \in U}\{R(X) : R(X) \subseteq X\}$ where R(X) denotes the equivalence class determined by $X \in U$.

(ii) The upper approximation of X with respect to R is the set of all objects, which can be possibly classified as X with respect to R and it is denoted by $U_R(X)$. That is $U_R(X) = \bigcup_{X \in U}\{R(X) : R(X) \cap X \neq \phi\}$.

(iii)The Boundary region of X with respect to R is the set of all objects, which can be classified as neither as X nor as not-X with respect to R and is denoted by $B_R(X)$. That is $B_R(X) = U_R(X) – L_R(X)$.

Definition 2.2.[6] Let R be an equivalence relation on the universe U and $\tau_R(X) = \{U, \phi, L_R(X), U_R(X), B_R(X)\}$ and $X \in U$. Then $\tau_R(X)$ satisfies the following axioms.

(i) U and $\phi \in \tau_R(X)$.

(ii) The union of the elements of any sub collection of $\tau_R(X)$ is in $\tau_R(X)$.

(iii)The intersection of the elements of any finite sub collection of $\tau_R(X)$ is in $\tau_R(X)$. That is,$\tau_R(X)$ is a topology on U called the Nano topology on U with respect to X. Thus (U, $\tau_R(X)$) as called as Nano topological space. The elements of $\tau_R(X)$ are called as Nano-open sets. A subset F of U is Nano-closed if its complement is Nano-open.

Definition 2.3.[9] Let $(U,\tau_R(X))$ be a Nano topological space. Then $\mu_R(X) = \{N \cup (N' \cap \mu)$: N, $N' \in \tau_R(X)\}$ and $\mu \notin \tau_R(X)$ is called the Micro topology in U with respect to X. The triplet $(U,\tau_R(X), \mu_R(X))$ is called Micro topological space and the elements of $\mu_R(X)$ are called Micro-open sets and the complement of a Micro-open set is called a Micro-closed set.

Definition 2.4.[4] Let $(U, \tau_R(X), \mu_R(X))$ be a Micro topological space and $x \in U$. Then a subset N of U is said to be Micro-neighbourhood of x (briefly Mic-N(x)), if there exists a Micro-open set L in U such that $x \in L \subseteq N$.

Definition 2.5.[2] An Information system is a pair IS = (U,A) where U is a non-empty finite set of objects called Universal set and A is a non-empty finite set of attributes such that $a:U \rightarrow V_a$ for every $a \in A$. The set V_a is called the value set of a.

Definition 2.6.[2] For any $P \subseteq A$ there is an equivalence relation called as Indiscernibility Relation (briefly IND (P)) which is defined as IND (P) = $\{(x,y) \in U^2$/ for all $a \in P$, $a(x)=a(y)\}$, which represents two objects are equivalent if and only if their attribute values are same in P.

Definition 2.7.[9] Let F= { $X_1, X_2,\ldots\ldots, X_n$} be a family of sets such that the set $X_i \subseteq U$, where i = 1,2,3,…,n. We say that X_i is Dispensable in F if $IND(F- X_i) = IND(F)$: otherwise the set X_i is Indispensable in F. The family F is Independent if all of its components are indispensable in F: otherwise F is Dependent. The family $H \subseteq U$ is a Reduct of F if H is independent and IND(H) = IND(F). The family of all indispensable sets in F will be called the Core of F.

Theorem 2.8.[9] Core (F) = $\cap$ Red (F), where Red (F) is the family of all reduct of F.

Definition 2.9.[14] Let $B \subseteq A$. It is possible to every subset X of the universe Ω, two sets $\underline{B(X)}$ and $\overline{B(X)}$ called, respectively, the B-Lower and B-Upper approximation of X specified as follows, $\underline{B(X)} = \{x \in \Omega: B(x) \subseteq X\}$, $\overline{B(X)} = \{x \in \Omega: B(x) \cap X \neq \phi\}$. The following coefficient of rough set can characterize the accuracy of the approximation

$\alpha_B(X) = \frac{\left|\underline{B(X)}\right|}{\left|\overline{B(X)}\right|}$, where $\left|\underline{B(X)}\right|$ denotes the cardinality of $\underline{B(X)}$.

Definition 2.10.[7] Let (U, $\tau_R(X)$, $\mu_R(X)$) be a Micro topological space and A $\subseteq$ U. Then A is said to be Micro S_p-open (briefly Mic S_p-open) if for each x$\in$A$\in$ Mic-SO(U, X), there exists a Micro pre-closed set F such that x$\in$F$\subseteq$ A. The set of all Micro S_p-open sets is denoted by Mic S_p-O(U,X).

Definition 2.11.[8] Let (U,$\tau_R(X)$, $\mu_R(X)$) and (V,$\tau_R(Y)$, $\mu_R(Y)$) be two Micro topological spaces. A function f: U $\rightarrow$ V is said to be Micro S_p-continuous function if f^{-1}(H) is Micro S_p-open in U for every Micro-open set H in V.

Definition 2.12.[8] Let (U,$\tau_R(X)$, $\mu_R(X)$) and (V,$\tau_R(Y)$, $\mu_R(Y)$) be two Micro topological spaces. A bijective function f: U $\rightarrow$ V is said to be Micro-homeomorphism if f and $f^{-1}$are both Micro-continuous.

Definition 2.13.[8] Let (U,$\tau_R(X)$, $\mu_R(X)$) and (V,$\tau_R(Y)$, $\mu_R(Y)$) be two Micro topological spaces. A bijective function f: U $\rightarrow$ V is said to be Micro S_p-homeomorphism if f and $f^{-1}$are both Micro S_p-continuous.

3. Applications Regarding Covaxin Vs Covishield: which is better in India.

In this section, an application from the real life problem is presented to find the best vaccine either Covaxin or Covishield by calculating the accuracy of the approximation of both Micro-neighbourhood and Micro S_p-neighbourhood methods. The decision have also been found the common side effects and compared the minimum impact of both the vaccines, which has been much discussed about recently by the following case study via Micro topological structures.

Case Study

The problem about Covaxin Vs Covishield is: which vaccine is better in India. This study reported short term side effects after vaccination with Covaxin and Covishield in at risk and healthy individuals. Much like other Vaccines in the offering, both Covaxin and Covishield carry reactogenic side effects. A cross sectional online survey was done by [3] which included questions pertaining to the immediate post vaccination experience in India. There are some of the more common side effects of vaccine might impact our regular life such as fever, nausea, head ache, fatigue, swelling at the injection site. Here the side effects have been analyzed and arrived at the most reliable conclusion with persons getting minimum impact. By collecting real data of persons from the Cross sectional online survey [11] and using the Micro topological structures to find which has the minimum impact of side effects.

We have the data of side effects (conditional attributes) of persons getting vaccinated and its impact (decision attributes) as a sort of table. We need to know the effective attributes and predictive results from this information system that help taking the decision for this problem.

There are two cases. The first will be discussed with the persons getting vaccinated with Covaxin and the second case will be discussed with the persons getting vaccinated with Covishield.

Case I: Information & Decision System of risk factors associated with Covaxin side effects.

Table 1

Person (U)	Attributes (A)				Decision (D)
	Fever	Swollen at injection site	Head ache	Fatigue	Impact
1	High	Yes	No	Yes	Max
2	Very high	Yes	Yes	No	Max
3	High	No	No	Yes	Min
4	High	Yes	Yes	No	Max
5	Normal	No	No	No	Min

In this information table1,

Let U = {1,2,3,4,5} be the universe, which is the set of persons who took the Covaxin to analyze. Let A = {Fever, Swollen at the injection site, Head ache, Fatigue} be the set of side effects of Covaxin, which are conditional attributes and D = {Max / Min} be the Impact of Covaxin, which is the decision attribute.

Table 1 is a decision table. Though there might be some attributes in this decision table are superfluous which are redundant. In order to remove the redundancy from the relation, we use the concepts of Reduct and Core.

IND(Fever, Swollen at injection site, Head ache, Fatigue) = IND(Fever, Swollen at injection site, Head ache).Thus 'Fatigue' is dispensable

IND(Fever, Swollen at injection site, Head ache, Fatigue) ≠ IND(Fever, Headache, Fatigue). Thus 'Swollen at injection site' is indispensable.

IND(Fever , Swollen at injection site, Head ache, Fatigue) ≠ IND (Swollen at injection site, Head ache, Fatigue).Thus 'Fever' is in dispensable.

IND(Fever, Swollen at injection site, Head ache, Fatigue) = IND(Fever, Swollen at injection site, Fatigue).Thus 'Headache' is dispensable.

Here 'Fatigue and Head ache' are dispensable attributes. So by eliminating these attributes from the Information system, it will not worse the classification. This means that, the classification defined by the set of 4 equivalence relation Fever, Swollen at injection site, Head ache and Fatigue is same as classification defined by Fever and Swollen at injection site. Hence the reduced table is,

Table 2

Person (U)	Attributes (A)		Decision (D)
	Fever	Swollen at injection site	Impact
1	High	Yes	Max
2	Very high	Yes	Max
3	High	No	Min
4	High	Yes	Max
5	Normal	No	Min

Reduct = {Fever, Swollen at injection site}.

Here IND(Fever, Swollen at injection site) ≠IND(Fever) and IND (Fever, Swollen at injection site)≠ IND(Swollen at injection site). Thus Fever and Swollen at injection site are independent. As there no more than one reduct, both will be considered as a core.

∴Core = {Fever, Swollen at injection site}.

Case II: Information & Decision System of risk factors associated with Covishield side effects.

Table 3

Person (V)	Attributes (A′)				Decision (D′)
	Fever	Fatigue	Nausea	Swollen at injection site	Impact
A	High	Yes	No	Yes	Max
B	Normal	No	Yes	Yes	Min
C	Normal	No	Yes	Yes	Min
D	High	Yes	No	No	Max
E	Very high	Yes	No	Yes	Max

From table 3, Let V = {a,b,c,d,e} be the universe, which is the set of persons who took Covishield vaccine to analyze. Let A′ = {Fever, Fatigue, Nausea, Swollen at injection site} be the set of side effects of Covishield, which are conditional attributes and D′ = {Max, Min} be the impact of Covishield, which is the decision attribute.

Table 3 is a decision table. Though there might be some attributes in this decision table are superfluous which are redundant. In order to remove the redundancy from the relation, we use the concepts of Reduct and Core.

IND(Fever, Fatigue, Nausea, Swollen at injection site) ≠ IND(Fever, Fatigue, Nausea). Thus “Swollen at injection site” is indispensable.

IND(Fever, Fatigue, Nausea, Swollen at injection site) = IND (Fever, Fatigue, Swollen at injection site). Thus “Nausea’ is dispensable.

IND(Fever, Fatigue, Nausea, Swollen at injection site) ≠ IND (Fatigue, Nausea, Swollen at injection site). Thus ‘Fever’ is indispensable.

IND(Fever, Fatigue, Nausea, Swollen at injection site) = IND(Fever, Nausea, Swollen at injection site. Thus ‘Fatigue’ is dispensable.

Here “Fatigue and Nausea” are dispensable attributes. So by eliminating these attributes from the information systems, it will not worse the classification. This means that the classification defined by the set of 4 equivalence relation Fever, Fatigue, Nausea and Swollen at injection site is same as classification defined by Fever and Swollen at injection site. Hence the reduced table is,

Table 4

Person(V)	Attributes (A′)		Decision (D′)
	Fever	Swollen at injection site	Impact
a	High	Yes	Max
b	Normal	Yes	Min
c	Normal	Yes	Min
d	High	No	Max
e	Very high	Yes	Max

Reduct = {Fever, Swollen at injection site}.

Here IND(Fever, Swollen at injection site) ≠ IND(Fever) and IND(fever, Swollen at injection site) ≠ IND (Swollen at injection site).Thus Fever and swollen at injection site are independent. As there no more than one reduct, both will be considered as a core.

∴Core = {Fever, Swollen at injection site}

From the above two cases, it is observed that the primary outcome which is meant to be the core is Fever and Swollen at injection site. Hence we resolve that the above two symptoms are common in both the cases.

4. Prediction of Covaxin Vs Covishield:

In this problem, the decision according to the attribute reduction is the common side effects of both the vaccines are Fever and Swollen at injection site. In fact, it is not exact solution for this problem. Vaccine′s successes cannot be determined by only their side effects. A higher prevalence of minor side effects does not imply that a vaccine is inferior in function to another vaccine with a lower prevalence of side effects. Our aim is to analyze the data using the Micro topological structures which will help us to determine which of the vaccine reporting minimum adverse events.

In this section, we have used Micro-continuous and Micro S_p-continuous approaches to build a prediction function structure which is capable of accurately predicting the existence of the side effects of Covaxin and Covishield. Moreover, based on the principle of accuracy of the approximation via Micro-neighbourhood and Micro S_p-neighbourhood approaches to find which Covid-19 vaccine is better in India.

Basic data of 5 persons those who have vaccinated with Covaxin is given in table 1 and another data of 5 persons those who have vaccinated with Covishield is given in table 2. Each person will feel some of these side effects after getting vaccination. After a period of time, we need to predict the results of the impact of vaccination over persons and accordingly we can decide the better one.

The information system given in table 2 & 4 can be represented in the following Micro topological structures.

Here, U = {1,2,3,4,5} with U|R = {{1,4}, {2}, {3}, {5}}and X = {Impact = Min} ={3,5}, then $\tau_R(X)$ = {U, ϕ,{3,5}}. If μ = {1} which is not in $\tau_R(X)$ then $\mu_R(X)$ = {U, ϕ, {1}, {3,5},

{1,3,5}}. Also V = {a,b,c,d,e} with V|R = {{a}, {b, c},{d},{e} and Y = {Impact = Min} = {b,c}, then $\tau_R(Y)$ = {V, ϕ,{b,c}}. If μ = {a} which is not in $\tau_R(Y)$ then $\mu_R(Y)$ = {V, ϕ,{a},{b,c},{a,b,c}}. Therefore, we defined the prediction function f from Micro topological space on U with respect to X to Micro topological space on V with respect to Y.

(i) Micro-Continuous Approach:

The above prediction function f: $(U,\tau_R(X),\mu_R(X)) \to (V,\tau_R(Y),\mu_R(Y))$ is defined as f(1) = a, f(2) = d, f(3) = b, f(4) = e, f(5) = c. According to the bijective function f, both f and f^{-1} are Micro-continuous, f is a Micro-homeomorphism. Thus the impact of Covaxin as a function of impact of Covishield is a Micro-homeomorphism. Hence the impact of Covaxin and Covishield" are similar and considered as both are equivalent in India.

(ii) Micro S_p-continuous Approach:

Consider the same Micro topological structures given in section 4, the Mic S_p-O(U,X) = {U,ϕ, {3,5}, {1, 2, 4}, {2, 3, 5}, {3, 4,5},{2, 3, 4,5}} and the Mic S_p-O(V,Y) = {V,ϕ, {b, c}, {b, c, d}, {a, d, e},{a, b, c, e},{b, c, d, e}}.

For the bijective prediction function f defined above, there does not exist a Micro S_p-continuous. Hence f is not a Micro S_p-Homeomorphism. Hence the impact of Covaxin as a function of impact of Covishield is not a Micro S_p-homeomorphism.

Thus the Micro S_p-continuous approach found a significant difference between Covaxin and Covishield. Which is a contradiction to the Micro-continuous approach discussed above.

5. Micro-Neighbourhood and Micro S_p-Neighbourhood approach for the Accuracy of the Approximation:

Our aim in this problem is to find the better Covid-19 vaccine in India. While both vaccines were protective, there were some differences in the protection accorded by the adverse events of these two vaccines. In this section, we define the Approximations via Micro-neighbourhood and Micro S_p-neighbourhood for comparing the efficacy of both the vaccines by using Accuracy of the Approximation of subsets X and Y of U and V respectively.

Let $(U,\tau_R(X),\mu_R(X))$ be a Micro topological space. For each $x \in U$, the Micro-lower (briefly Mic-$L^n_R(X)$), the Micro-upper (briefly Mic-$U^n_R(X)$) approximation and the Micro-boundary (briefly Mic-$B^n_R(X)$) region of a subset X of a non-empty finite set U with respect to the neighbourhoods are defined respectively as follows:

1. Mic-$L^n_R(X) = \bigcup_{X \in U}\{ x : \text{Mic-N}(x) \subseteq X\}$
2. Mic-$U^n_R(X) = \bigcup_{X \in U}\{ x : \text{Mic-N}(x) \cap X \neq \phi\}$.
3. Mic-$B^n_R(X)$ = Mic-$U^n_R(X)$ – Mic-$L^n_R(X)$.

To calculate the Accuracy of the Approximation of X and Y via Micro-Neighbourhood, Mic-$\beta\mu^n_R(X) = \frac{|\text{Mic}-L^n R(X)|}{|\text{Mic}-U^n R(X)|} = \frac{|\{3,5\}|}{|\{2,3,4,5\}|} = 0.5$, Mic-$\beta^n\mu_R(Y) = \frac{|\text{Mic}-L^n R(Y)|}{|\text{Mic}-U^n R(Y)|} = \frac{|\{b,c\}|}{|\{b,c,d,e\}|} = 0.5$.

Therefore Mic-$\beta\mu^n_R(X)$ = Mic-$\beta\mu^n_R(Y)$ which implies that the impact of both the vaccines are same via Micro-neighbourhood approach.

Also, Let $(U,\tau_R(X),\mu_R(X))$ be a Micro topological space. For each $x \in U$, the Micro S_p-lower (briefly Mic S_p-$L^n_R(X)$), the Micro S_p-upper (briefly Mic S_p-$U^n_R(X)$) approximation and the Micro S_p-boundary (briefly Mic S_p-$B^n_R(X)$) region of a subset X of a non-empty finite set U with respect to the neighbourhoods are defined respectively as follows:

1. Mic S_p-$L^n_R(X) = \bigcup_{X \in U}\{ x : \text{Mic } S_p\text{-}N(x) \subseteq X\}$
2. Mic S_p-$U^n_R(X) = \bigcup_{X \in U}\{ x : \text{Mic } S_p\text{-}N(x) \cap X \neq \phi\}$.
3. Mic S_p-$B^n_R(X)$ = Mic S_p-$U^n_R(X)$ – Mic S_p-$L^n_R(X)$.

To calculate the Accuracy of the Approximation of X and Y via Micro S_p-Neighbourhood, Mic S_p-$\beta\mu^n_R(X) = \frac{|\text{Mic } S_p - L^n R(X)|}{|\text{Mic } S_p - U^n R(X)|} = \frac{|\{3,5\}|}{|3,5|} = 1$, Mic S_p-$\beta\mu^n_R(Y) = \frac{|\text{Mic } S_p - L^n R(Y)|}{|\text{Mic } S_p - U^n R(Y)|} = \frac{|\{b,c\}|}{|\{b,c,d,e\}|} = 0.5$. Therefore, Mic S_p-$\beta\mu^n_R(X)$ > Mic S_p-$\beta\mu^n_R(Y)$ which implies that Covaxin is better than Covishield via Micro S_p-neighbourhood approach.

6. Results and Discussions

After taking the Covaxin or Covishield, these side effects are pretty common and seen in 95 % of the cases and the side effects are very mild and moderate, only less than 5 % of the cases with the underlying health conditions such as previous co-morbid conditions or previous severe allergic reactions or may be if the patients are under cancer treatment or immunocompromised individuals, for these individuals only serious side effects can be seen but they are not life threatening at all. But in contrast, a recent study found several individuals develop blood clot, cardiovascular effects, heart attacks and strokes after taking Covishield vaccine. Moreover, according to Dr.Assem Malhotra, a well known British-Indian cardiologist: “Covishield shouldn′t have been rolled out”. That is “the more shots you have the greater the chance of suffering a serious side effect”. Then there is an evidence of reduced effectiveness against the Covishield vaccine, even after a third dose. These events may worse the performance of the Covishield vaccine.

When it comes to mapping effectiveness, we can say that Micro-homeomorphism performs well in prediction of Covaxin Vs Covishield impacts. But the decision of the data set taken for finding the accuracy of comparision between Covaxin and Covishield by Micro S_p-homeomorphism, Covaxin is better than Covishield. Additionally, there has been clinical evidence [13] reported that post vaccination side effects are more in Covishield recipients than in Covaxin recipients. Hence Covaxin is finer than Covishield.

7. Study Limitations

The information collected from an existing data is taken as the basis for analyzing the side effects of Covid-19 vaccines in India. The major disadvantage of an existing data in demography is not specific to the researchers needs due to the fact that it was collected in the past for another reason. That is why the analysis of existing data might be unreliable for testing the particular hypothesis.

8. Conclusion

Natural immunity is very very powerful. There is no requirement for persons having underlying health conditions to have a booster doses especially as we know the side effects are incremental. This study investigated short-term side effects produced from acquiring Covid-19 vaccines (Covaxin and Covishield). Both the vaccines have fewer differences and more resemblances. Covaxin and Covishield both work effectively to lessen the risk of Covid-19 infections. Most people with short-term side effects feel better within a few days or weeks of their post vaccination. But for some people, side effects can last longer. This long-term side effects is a new condition which is still being studied. This will be focused for our future research.

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